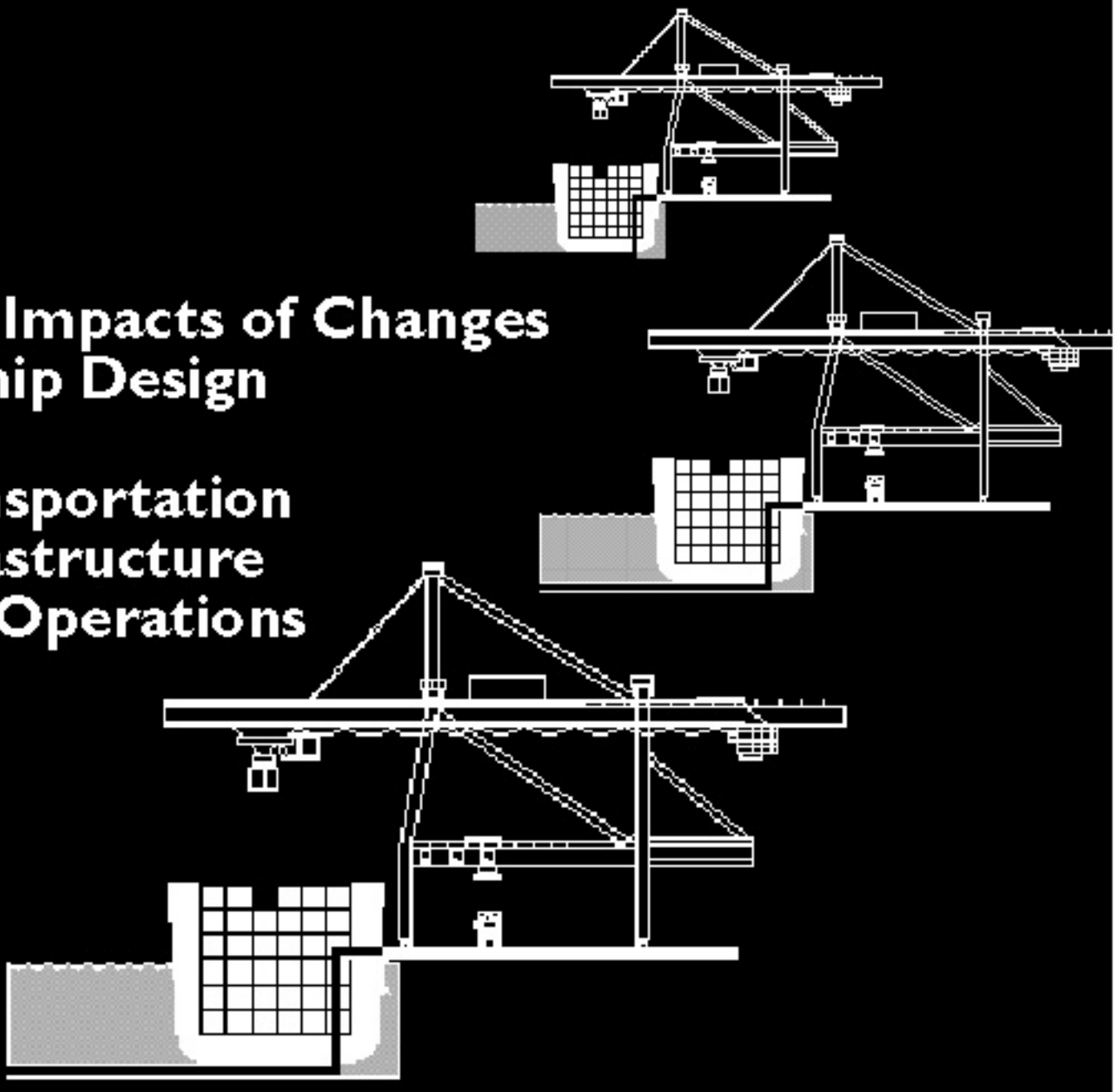
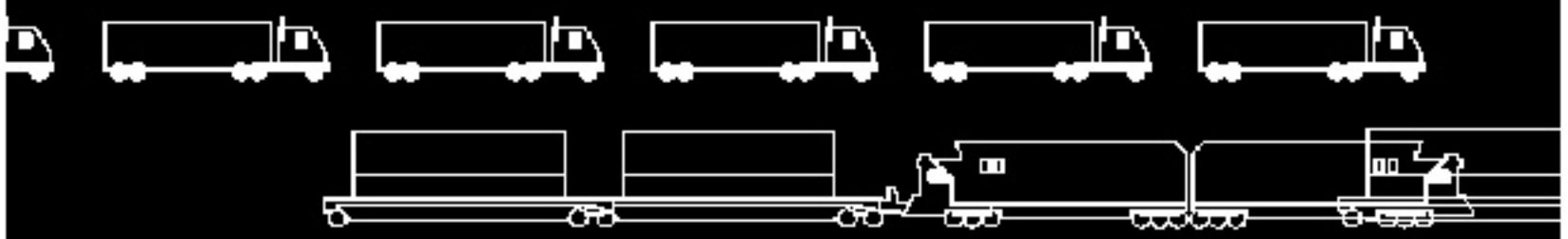
U.S. Department
of Transportation

Office of Intermodalism

February 1998

The Impacts of Changes in Ship Design on Transportation Infrastructure and Operations





Executive Summary

This report presents the input received by the U.S. Department of Transportation (USDOT) at four regional meetings addressing the question of how the growth in worldwide containerized trade and the expected growth in volumes of freight handled by major container ports will place additional demands on the U.S. transportation system. The meetings paid particular attention to the introduction of large containerships (megaships) and their potential impact on freight transportation within the United States. The series of regional megaship meetings were successful in getting participants from Federal, State, and local agencies and the private sector to think about solving the full spectrum of transportation problems created by larger ships calling on U.S. ports.

The megaship study was carried out through a cooperative effort that involved the following USDOT Offices and Agencies: the Secretary's Office of Intermodalism, the Federal Highway Administration, the Maritime Administration, the Federal Railroad Administration, and the U.S. Coast Guard. Other Federal agencies with significant participation at the regional meetings included the Department of Defense (including the Army Corps of Engineers), the U.S. Customs Service, and the Environmental Protection Agency.

The fundamental issue addressed in these conferences was how improving infrastructure links to ports is a critical prerequisite for transportation to function as a system. In the regional meetings, the major factors and requirements for infrastructure planning and investment occasioned by changes in ship design were:

- Megaships are being constructed with carrying capacities exceeding 4,500 TEUs (twenty-foot equivalent units) and/or fully-loaded design drafts of 40 to 46 feet, and some major U.S. ports are currently unable to handle them.
- International ports are expanding capacity to meet the challenge of megaships and the projected growth in trade.
- How transportation inefficiencies can be reduced was at the crux of the megaship meetings, as was the dilemma posed by conflicting demands for increased investment in a fiscally-constrained environment.
- On the question of whether carriers would be likely to share in the cost of infrastructure investments occasioned by their vessels, port officials noted that carriers have not paid their full share of port infrastructure improvements to date, nor do ship owners typically consult with ports on long range planning for port infrastructure.
- The U.S. Treasury receives $150 billion annually in tax revenues from goods handled by U.S. ports, and continued investment in our ports is essential to ensure that they remain competitive in the global economy and act as a vital component of our national security infrastructure.
- Port and local representatives believed that more of the fees and duties collected at the ports ought to be returned to the ports that collect them.
- In addition to providing money for large scale capital improvements, the Federal Government could create incentives to reward public and quasi-public entities for becoming more transportation efficient.

- The challenge to transportation decisionmakers is to consider differences between the commercial life and operational life of an investment—what is the likely long-term impact of investments made to increase transportation capacity to accommodate potential port calls by larger and/or faster ships?
- Industry representatives called for the U.S. DOT to provide a more logical user-based fee to eliminate the disparity between donors and donees and greater flexibility to finance other improvements necessitated by growth.
- Attendees felt that there are two differing planning processes that have to be resolved—State planners typically have a 5- to 10-year planning horizon, while the operating horizon of a carrier is typically of shorter range. Longer range planning is usually not shared with port service providers.
- The feedback from the regional meetings clearly called for Federal agencies to provide a planning framework for economic analysis that could assess implications of larger scale, corridor-based transportation improvements.
- Port and other transportation industry participants recognized the dilemma in not wanting port rationalization or national transportation planning, but wanting the Federal Government to set priorities for major transportation investments.
- Concerted action would have to be taken on both analytical and political processes if sound, quantitatively-based frameworks for project investment are to be approved.

There are three major national public policy issues raised by the prospects of extremely large containerships: the historic and ongoing deregulation of the transportation industry, the devolution of transportation programs, and the need for optimizing our nation's freight movement system. Deregulation has allowed the formation of partnerships within and between transport modes to achieve optimization of end-to-end distribution logistics and transport costs. Devolution has enabled the empowerment of States and metropolitan planning organizations to play a larger role in transportation decisionmaking. Private shippers and public agencies are seeking to optimize the transportation system to move the most goods and people with the widest range of modal choices at the most economical cost and the greatest efficiency.

In considering the appropriate response to the new transportation technology, we can turn to historical examples where optimization of the nation's freight transportation network—by the Federal Government, by States and communities, and by transportation companies—has been vitally needed and successfully accomplished. For its part, USDOT is actively engaged in:

a) Defining the national interest with respect to freight movement through proposals for reauthorizing surface transportation programs, the National Highway System intermodal connections, the Water Resources Development Act and other initiatives.

b) Providing equitable and appropriate funding for water and landside access and infrastructure improvements, and other projects which benefit both local transportation and a defined national interest, such as the Alameda Corridor.

c) Facilitating improved coordination in the decision chain among and between vessel designers, ports/waterways management, state and municipal landside access planners (including multi-state freight transport planning), and private shipping companies.

Conclusions

The report concludes that action should be taken now to craft policies to position the U.S. transportation industry to handle the significant increases in international freight movements and the infrastructure demands of the changing trade flows and port calls by larger and faster vessels. If policies and programs are to be developed to address these transportation needs, action must be taken to engage both the agencies responsible for their oversight and the constituents that are affected.

The report acknowledges two ongoing activities within USDOT that will address the transportation system's accommodation of increased future volumes of international intermodal freight:

1) USDOT's Waterways Management Initiative: This initiative, led by the U.S. Coast Guard and the Maritime Administration, will bring together the many agencies with responsibility for waterways management to coordinate and consolidate the delivery of all Federal services and promote port efficiency. Waterways Transportation Management will focus on policy coordination at the national level and action at the local port level. Adequate infrastructure, including channel and berth depths, navigation information, port facilities, intermodal connections and information management to accommodate all classes of marine vessels—including large container vessels—are among the waterways issues encompassed within this initiative.

2) USDOT's Assessment of the Conditions and Performance of National Highway System (NHS) Intermodal Connectors: This Federal Highway

Administration initiative will compile information on the NHS connections to major passenger and freight intermodal terminals, including 500 freight terminals. Using input from other USDOT operating administrations and public/private databases at national, State, and local levels, the FHWA will:

a) Evaluate highway infrastructure condition of National Highway System (NHS) connections to major intermodal terminals.

b) Identify improvements that have been made or are being planned for intermodal connections and identify impediments to making improvements to them.

c) Identify other non-highway infrastructure, regulatory, institutional and operational impediments to intermodal terminal access.

The Department of Transportation believes that the challenges of increased movements of international freight can be met only through the coordinated efforts of the wide range of transportation stakeholders with interests in this area. These efforts will require significant investments of time, energy, and funds and continuous dialogue with our constituents if we are to be successful in meeting the transportation needs of the future.

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Introduction

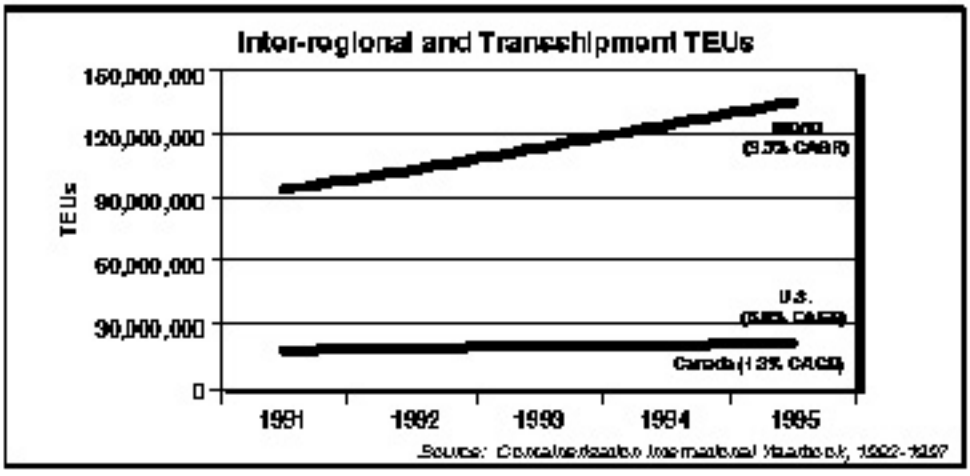
In the spring and summer of 1997, the U.S. Department of Transportation (USDOT) conducted a series of four regional meetings around the country to address transportation impacts of changes in ship design and shipping practices occurring in the intermodal shipping industry. These meetings examined existing transportation infrastructure, market trends, and how transportation planning should consider freight distribution systems that must serve both domestic and global needs. The fundamental issue addressed in these conferences was how improving infrastructure links to ports is a critical prerequisite for transportation to function as a system.

There are new dynamics in intermodal shipping caused by the elimination of international trade barriers, lower tariffs, and shifting centroids of global manufacturing and consumption. Many new trade gateways are developing which dramatically alter market demand and future cargo forecasts. Trade worldwide is growing, with 55 percent of all general cargo in international liner trade being moved in containers. Worldwide containerized trade is growing at annual rates of 9.5 percent, with 6.0 percent at United States ports and 1.5 percent at Canadian ports. By 2010, experts predict that 90 percent of all liner freight will be shipped in containers. The trend for growth is inexorably up, and every major container port is projected to double and triple its cargo traffic by 2020.

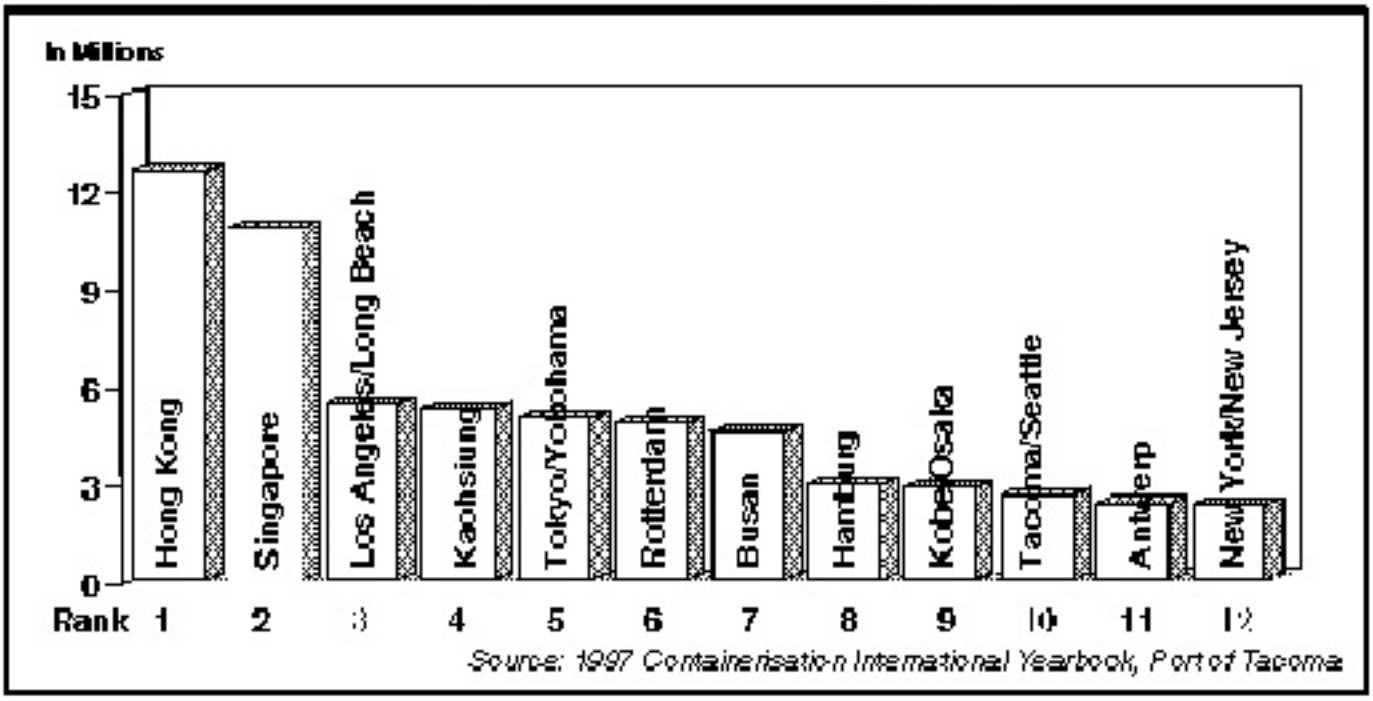
Compared to the impacts forecast for containerized freight, growth in overall volumes non-containerized commodities is expected to be substantially less (in the 1 to 3% range) and changes in ship design for these commodities will be much less significant in terms of transportation logistics and landside impacts.

Containerized growth in Asia is growing by as much as 25 percent annually. Hong Kong has developed a plan to handle 32 million containers per year by 2010, far exceeding the projected volumes for the very largest U.S. ports. There are no differences in the technology used at the major international ports that

World Container Port Traffic, (1991–1995)



1997 Top World Container Gateways (TEUs)

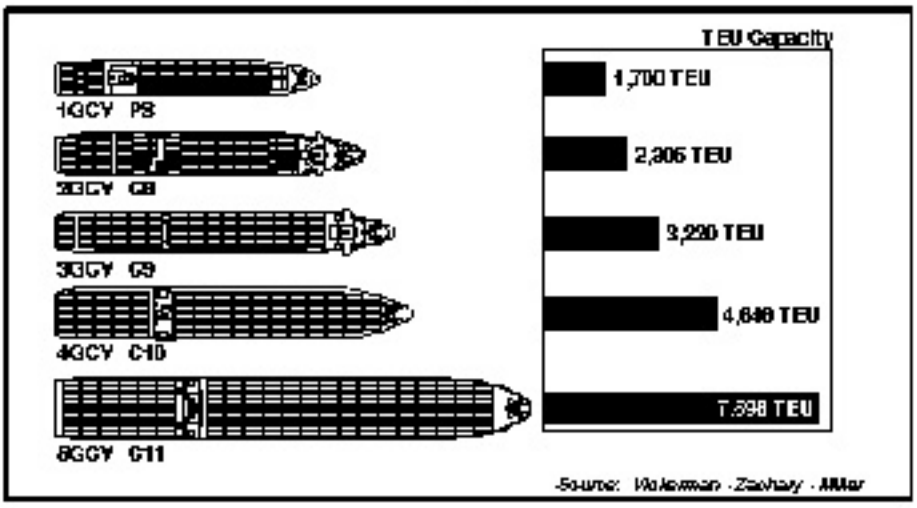


enable these ports to handle such large volumes of freight—the efficiencies are made possible by different labor agreements, operating procedures, administrative policies, and the nature of the trade in foreign countries. Our Nation's ports and their modal connections must make improvements in these areas as well, and not just in the construction of additional capacity or the reliance upon new technology, if they are to remain globally competitive and efficient components of the U.S. transportation system.

Assuming that adequate port infrastructure is available, by 2010 nearly 33 percent of general cargo tonnage will be transported by ships carrying more than 4,000 twenty-foot equivalent (TEU) container units. Megaships are being constructed with carrying capacities exceeding 4,500 TEUs and/or fully-loaded design drafts of 40 to 46 feet, and some major U.S. ports are currently unable to handle them. International ports are expanding capacity to meet the challenge of the coming megaships and the projected growth in trade. As the new containerships come into service, new routes and transshipment hubs will develop. American ports face new challenges to increase their infrastructure capacity but also new opportunities to develop markets for their services.

As a general rule, containerships will continue to get larger if costs per transit mile continue to go down. Eight percent of new ship orders are for megaships, none of which are being built in U.S. shipyards nor scheduled to fly the U.S. flag, but these ships could ultimately carry 20 percent of total containerized cargo. Ships in the 6,000 to 9,000 TEU range will grow to be about 9.5 percent of the total fleet by 2010. Megaships are more costly to build than their predecessors—$70 million for post-Panamax class vessels up to 4,800 TEUs vs. an estimated $100 million for megaships, with unit costs varying depending on the design characteristics and number of vessels

Container Ship Evolution



ordered. Megaships offer operational benefits through lower per transit costs, reduced transit time, and fewer numbers of required vessels. Because megaships are extremely capital expensive, carriers will deploy them in concentrated trade lanes and operate them over longer routes and call on fewer ports. These vessels offer economies of scale at sea, but could incur diseconomies of scale in port. Thus carriers seek to integrate landside with water economies.

Megaships, while costly in aggregate, have lower construction and operating costs per TEU of containerized freight. High-speed hull designs cut transit times, and faster transit and port turn-around times reduce the number of vessels required to maintain weekly departure schedules. Carriers will invest in megaships to increase their market share and get additional business from shippers through reduced container slot costs. The newer, larger ships cannot easily be re-deployed logistically because of port and vessel capacity constraints, and carriers will seek consistent cargo volume to stabilize rates. Every operating advantage must be squeezed out of ships to recover the greater costs of building and operating these vessels.

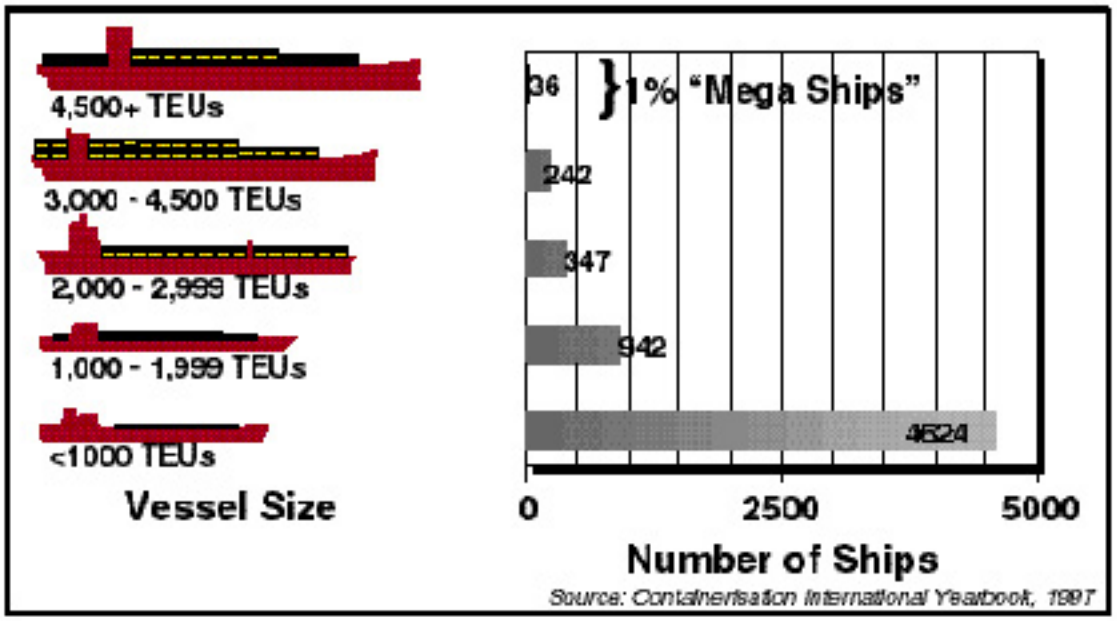
For a port to service these megaships the entire portside infrastructure will have to get bigger and more productive. Each channel, berth, and turning basin must be at least 50 feet in depth, since 40 to 46 feet will be the maximum draft for fully- loaded megaships. Megaship ports will be required to have cranes to reach across the 21 container-wide megaships as well as feeder ship to megaship transfers. Stronger wharves are also likely to be required by the ports where megaships call. Wharf strengthening may be needed to: 1) support more and heavier cranes; and/ or 2) accommodate deeper drafts at berths (in some cases deepening to accommodate megaships could undermine existing pilings); and/ or 3) support more yard equipment (trucks, yard hostlers, etc.); and/ or 4) support rail cars on the wharf.

Ports are projected to experience dramatic growth in containerized cargo, but not every port will have to increase capacity to accommodate megaships. Regardless of whether megaships call on a given port, the introduction of these vessels will have a ripple effect throughout the transportation system, not just regionally, but nationally.

If megaships call on U.S. ports, then the ports and the supporting transportation system must be able to respond. To recover their investment in a megaship, operators must minimize the time a ship is in port to maximize the number of trips it makes. The reduced time in port, plus the higher number of containers carried by a megaship, increase the peak container traffic that must be moved through the port and the surface transportation system that serves it. Except in limited markets served by inland waterways, shippers have three choices for the inland movement of containerized freight from port terminals—highways, rail, or barges/ feeder ships. The modal split that reflects how this traffic is to be moved has a profound effect on the design of terminals, both within the port and for truck, rail, and feedership/barge terminals as well.

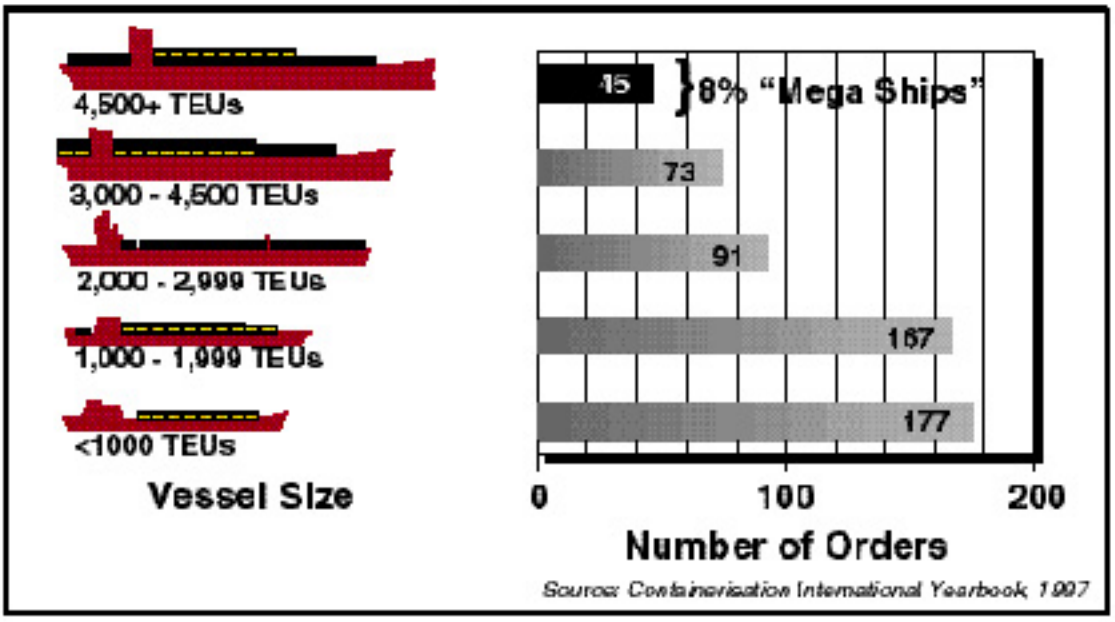
For our Nation to preserve and enhance its competitive position in world trade, we must reduce the cost of transportation by eliminating inefficiencies. How transportation inefficiencies can be reduced was at the crux of the megaship meetings, as was the dilemma posed by conflicting demands for increased investment in a fiscally-constrained environment.

World Containership Fleet as of November 1996



Source: Containerisation International Yearbook, 1997

World Containership Orders as of November 1996



A technical appendix at the end of this report presents background information summarizing aspects of transportation infrastructure, market trends, and transportation planning that must be considered in developing an appropriate response to the introduction of megaships. This background information was mailed to regional participants in advance of the meetings to acquaint them with the issues that would be addressed and the factors that were thought to be relevant to the discussion. Readers interested in more technical information pertaining to the introduction of megaships should refer to the technical appendix.